A NEW SPECIES OF *ERYTHRONIUM* (LILIACEAE) FROM THE COAST RANGE OF OREGON

PAUL C. HAMMOND
2435 E. Applegate St., Philomath, OR 97370

KENTON L. CHAMBERS
Department of Botany and Plant Pathology,
Oregon State University, Corvallis 97331

ABSTRACT

A new species, **Erythronium elegans,** is described from three sites in the northern Coast Range of Oregon. On morphological grounds the species is closely allied with *E. montanum* of the Olympic Mountains and northern Cascade Range, and with *E. klamathense* of the southern Cascades. Its variability in certain traits such as flower color, stamen width, and leaf mottling is suggestive of past hybridization with the geographically associated species, *E. revolutum.*

During 1982, the U.S. Forest Service initiated a project to study the distribution and ecology of *Erythronium revolutum* Smith along the Oregon Coast in order to assess conservation requirements for the species (Bierly and Stockhouse 1982). In the course of this study, large populations of a distinctly different *Erythronium* were discovered on the top of Mt. Hebo (945 m) in Tillamook County just 10 miles inland from the Pacific Ocean. Two additional populations of this taxon have since been found, one on Saddleback Mountain in northern Lincoln County 15 miles south of Mt. Hebo, and another on Fanno Ridge north of Valsetz in Polk County. The species exhibits a combination of characteristics seen in no other described taxon, and it forms a link between sections *Concolorae* and *Pardalinae* as defined by Applegate (1935). In this paper we describe this *Erythronium* as new and examine evidence concerning its origin and relationships.

Erythronium elegans Hammond & Chambers, sp. nov.

Herba perennis, foliis duo concoloris raro maculosis petiolo subterraneo lamina lanceolata prostrata, scapo 16–30 cm alto, floribus 1–2(–4) cernuis tepalis reflexis lanceolatis 2–4(–5) cm longis albis basi luteis dorsaliter plerumque roseis, filamentis 0.5–2.0 mm latis, antheris luteis, stylo 1–3 cm longo, stigmate profunde trifurcato, capsula clavata 2.5–3.5 cm longa.

Corm 2.0–5.5 cm long, 8–15 mm wide, enclosed in papery sheaths and producing new cormlets laterally; subterranean stem between

MADROÑO, Vol. 32, No. 1, pp. 49–56, 15 February 1985

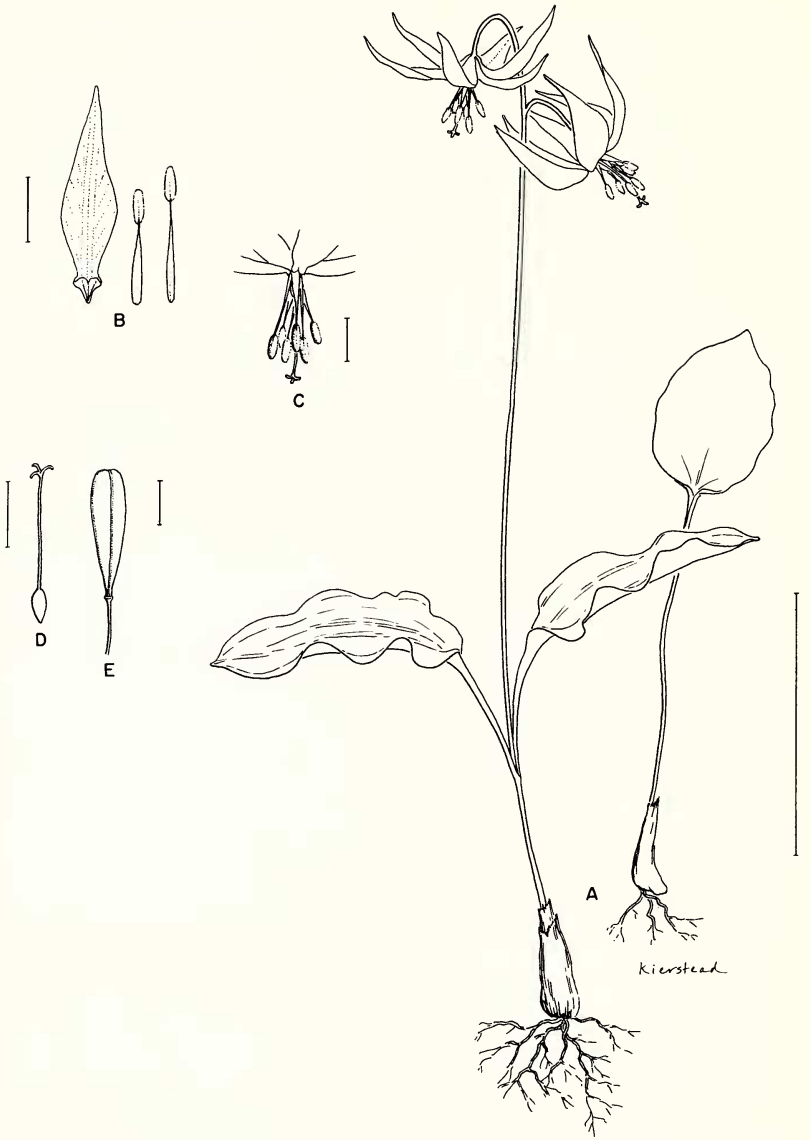

FIG. 1. *Erythronium elegans*. A. Habit of flowering and non-flowering individuals. B. Inner tepal and pair of stamens. C. Androecium and exserted style. D. Gynoecium. E. Capsule. Scale equals 10 cm in A, 1 cm in other Figs.

leaves and corm 3.5–10 cm long; leaves usually uniformly deep green or mottled with a few pale lines, rarely with well-developed brown mottling; leaf of non-flowering plants single, 6–8 cm long, 4–5 cm

wide, the blade broad, ovate-lanceolate, usually abruptly narrowed to a slender, nearly wingless petiole; leaves of flowering plants two, more or less prostrate, 7–13(–15) cm long, 2–4(–8) cm wide, the blade narrowly lanceolate, usually with strongly undulate margins, gradually narrowed to a short, evidently winged petiole; scape 16–30 cm tall; flowers 1–2(–4), nodding, with perianth strongly reflexed in bright sunshine to only slightly spreading under shady or cloudy conditions; perianth segments lanceolate, 2–4(–5) cm long, (3–)5–10(–15) mm wide, with well-developed basal appendages, white or pale pink with bright yellow stripes at the base, often reddish on abaxial surface; filaments narrow to somewhat dilated, 0.5–2.0 mm wide; anthers golden yellow, not connivent around style; style filiform, 1–3 cm long; stigma deeply divided with recurved lobes; capsule broadly clavate, blunt, 2.5–3.5 cm long, 6–8 mm wide.

TYPE: USA, OR, Tillamook Co.: Mt. Hebo, T 4 S R 9 W S 13, ca. 945 m, open sites on rocky slopes and cliffs, *P. Hammond s.n.*, 28 May 1982 (Holotype: OSC; isotype: UC).

PARATYPES: OR, Tillamook Co.: Mt. Hebo, open slopes with *Gaultheria* and *Vaccinium, Pseudotsuga* belt, 945 m, *Constance and Beetle 2656* (ORE, WILLU); Mt. Hebo, 914 m, plentiful under *Pseudotsuga, Thuja, Picea* and in open meadows with *Gaultheria, Vaccinium,* grasses, *Lupinus, Fragaria,* mosses, *Greenleaf 1301* (OSC, ORE, NY); Mt. Hebo, *A. M. Phillips s.n.*, 24 May 1954 (OSC). Lincoln Co.: Lost Prairie, Saddleback Mtn. at edges of bog, T 7 S R 9 W S 2, *S. Lofton s.n.*, May 1982 (MOC). Polk Co.: Fanno Ridge, bog at headwaters of Little Luckiamute River, T 8 S R 8 W S 14, *L. Scofield s.n.*, 25 May 1983 (MOC).

Populations of this species extend over the entire length of the Mt. Hebo escarpment, an area of some three square miles, and occupy meadows, rocky cliffs, brushland, and open coniferous forest. In many areas thousands of plants carpet the ground in a manner like that of *E. montanum* in subalpine meadows of the northern Cascade Range. The Saddleback Mountain and Fanno Ridge populations of *E. elegans* are much smaller and are largely restricted to the edges of sphagnum bogs. Additional populations of the species may be expected in mountain bogs, meadows, or rocky balds of northern Lincoln County and in Polk and Tillamook Counties.

Populations of *E. elegans* show considerable variation in leaf mottling, flower color, and stamen filament width. Most plants have completely unmottled leaves that are uniformly deep green or exhibit a few pale lines along the veins. Well-developed brown mottling is found in occasional plants, however, and may be so extensive that the leaves are almost entirely brown. The frequency of such extreme mottling is roughly estimated at about one in 10,000 plants on Mt. Hebo, but some local colonies consist largely of mottled plants. The majority of individuals have a pinkish-white perianth, often with

deeper pink on the abaxial side of the tepals. However, flower colors vary from deep rose-pink at one extreme to pure white at the other. The dilation of the stamen filaments is also variable. In a sample of 174 flowers on Mt. Hebo, 62 (36%) had thin filaments about 0.5 mm wide, and 112 (64%) had dilated filaments of 1.0–2.0 mm. In most plants the stamens spread away from the style, but in a few plants they are constricted around the style, as in *E. revolutum.*

Sympatric with *E. elegans* on the rocky cliffs of Mt. Hebo is *E. grandiflorum* Pursh var. *pallidum* St. John. Its leaves are similar in shape to those of *E. elegans* but differ in their blue-green color. The two species exhibit floral differences as well, and there is no evidence of hybridization between them. In western Oregon there are four additional species of *Erythronium* with which *E. elegans* can be compared. These are *E. revolutum, E. montanum* Watson, *E. oregonum* Applegate, and *E. klamathense* Applegate. Applegate (1935) divided the genus *Erythronium* into two sections: the *Pardalinae,* found in lowland habitats and having mottled leaves and white to lavender flowers; and the *Concolorae,* occurring in mountain habitats and having unmottled leaves and white to yellow flowers. *Erythronium montanum* and *E. klamathense* belong to sect. *Concolorae,* while *E. oregonum* and *E. revolutum* belong to sect. *Pardalinae.* However, *E. elegans,* as described here, is intermediate between the two sections in certain of its characteristics. In order to understand this relationship, it is useful to review the biogeography and ecology of the five allied species.

Both *E. montanum* and *E. klamathense* have white flowers, narrow filaments, and unmottled leaves. They occupy habitats at high elevations in the Cascade Range, including subalpine meadows and wet forests. *Erythronium montanum* is distributed from Vancouver Island and the Cascades of southern British Columbia southward to the Olympic Mountains and through the Cascades to Monument Peak in northern Linn County, Oregon. It differs from *E. klamathense* by the larger size of the plants and flowers (tepals 25–40 mm long), deeply divided stigma lobes, erect flowers, long and slender aerial petioles that raise the leaves above the ground, and abruptly expanded leaf blades. In contrast, *E. klamathense* is restricted to the southern Cascade Range extending from Black Rock Lookout in Douglas County, Oregon, south to the Mt. Shasta region of Siskiyou County, California. The species is smaller than *E. montanum* (tepals 15–25 mm long) and has entire stigmas, pendulous flowers, short subterranean petioles, prostrate leaves, and gradually expanded leaf blades.

Erythronium revolutum and *E. oregonum,* the closest geographical associates of *E. elegans,* both have dilated stamen filaments and distinctly mottled leaves. The flowers of *E. oregonum* are creamy-white, with the stamens spread away from the style (contrary to the

illustrations in Hitchcock et al. 1969, p. 792), whereas those of *E. revolutum* are deep pink and the filaments are appressed to the style (as illustrated by Hitchcock et al. 1969, and Gilkey 1945). These two taxa occupy mostly lowland habitats west of the Cascades from southern British Columbia to southern Oregon; *E. revolutum* continues south to Mendocino County, California. Except in the northern part of this range, the two species are rarely sympatric because *E. revolutum* occupies the coastal rain-forest zone and *E. oregonum* occurs in drier forests and woodlands of the interior. As observed by us in Oregon, *E. revolutum* is best developed in low-lying riparian habitats in the portion of its range south of the Siuslaw River, Lane County. These habitats include streamside benches above the high-water line, rotting log-jams, and rocky ledges. North of the Yaquina River, Lincoln County, the species shifts to moist coniferous forests on mountain slopes, reaching 900 m elevation on Onion Peak, Clatsop County. In the vicinity of Mt. Hebo, *E. revolutum* occurs on mountainsides above Powder Creek and Limestone Creek on the north and east sides of the peak below the main escarpment, where it is separated by 600 m elevation from the main population of *E. elegans.* It should be noted that *E. oregonum* is sometimes present in open meadows or "balds" on the tops of high Coast Range peaks, including Roman Nose Mountain in Douglas County, Marys Peak in Benton County (elevation 1200 m), and Rickreall Ridge in Polk County. These meadow habitats are superficially similar to those occupied by *E. montanum* in the Cascade Range, and by *E. elegans* on Mt. Hebo. The population of *E. oregonum* on Rickreall Ridge is ecologically isolated from *E. elegans* on nearby Fanno Ridge, however, since the former is on an exposed rocky ridge and the latter is in a cold bog.

In summary, the habitats of *E. elegans* are more similar overall to those of *E. revolutum* in this part of Oregon than to the habitats of *E. oregonum.* There may have been sympatry between *E. revolutum* and *E. elegans* at some time in the past, with an opportunity for introgression into the latter species of such traits as pink flower color, dilated filaments, and mottled leaves. These traits are found in all three disjunct populations of *E. elegans,* suggesting that introgression is not a recent event. There is presently no evidence that *E. elegans* and *E. oregonum* have had genetic contact through hybridization, however.

The morphological traits that suggest introgression by *E. revolutum* affect only a small minority of the plants of *E. elegans,* and we do not believe that the new species is itself of hybrid origin. The basic affinities of *E. elegans* appear instead to be with *E. montanum* and *E. klamathense.* The habitats of the three taxa are similar, although at present they are widely separated geographically. *Erythronium elegans* is like *E. montanum* in its flower size and its deeply

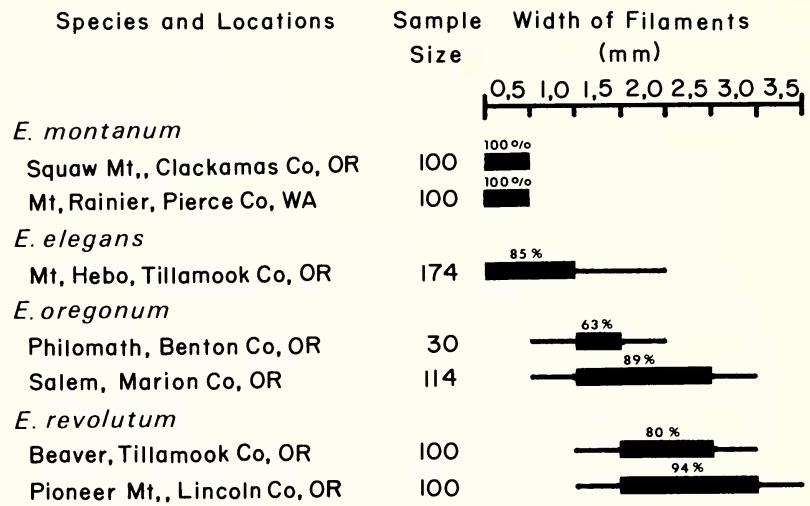

FIG. 2. Width of stamen filaments in four species of *Erythronium*. Range of variation is given for each population, with the frequency of the most common class shown as a labeled rectangle.

divided stigma lobes; it resembles *E. klamathense* in having pendulous flowers, prostrate leaves with short subterranean petioles, and blades tapering gradually at the base. Figures 2 and 3 illustrate the variation in two critical morphological features, the width of the stamen filaments and the angle formed by the tapering base of the leaf blade, in selected populations of four species under discussion. All measurements were taken from living plants in the field. The filament width in *E. elegans* is commonly in the range of *E. montanum* but varies toward the broad filaments of *E. revolutum* and *E. oregonum*. The basal angle of the leaf blades of *E. montanum* is variable, but the most frequent condition is to have a larger angle (that is, a more abruptly tapering blade) than in *E. elegans*. Figure 2 also illustrates that filament width cannot be used to separate *E. oregonum* from *E. revolutum*, despite the assertion by Applegate (1935, p. 100).

In the above discussion, *E. elegans* has been compared with its congeners for all the characteristics commonly used by taxonomists to distinguish species of *Erythronium*. We hypothesize that some of the present variability of this new taxon derives from past hybridization with *E. revolutum*, but that the origin of the species lies in an ancestral complex from which both *E. montanum* and *E. klamathense* are also derived. Putatively primitive traits recognizable in *E. elegans* are its separate stigma lobes, its pendulous flowers, and

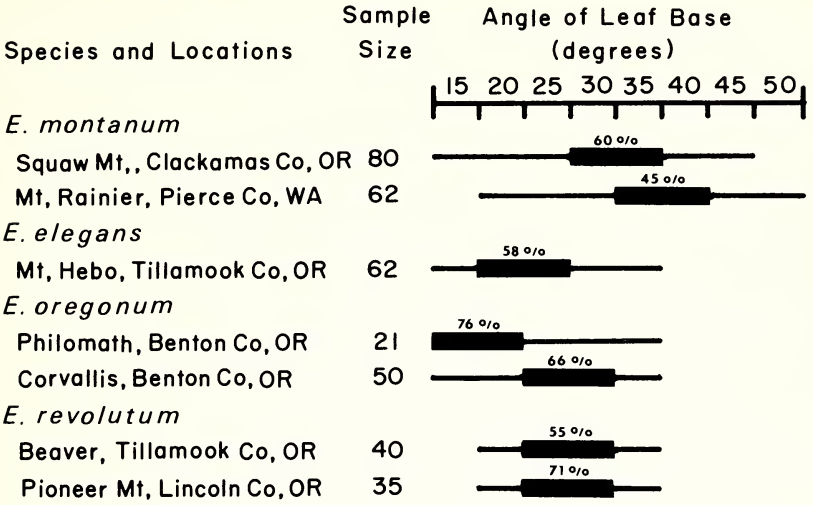

FIG. 3. Angle of leaf base in four species of *Erythronium*. Measurements are the angle, in increments of five degrees, from the petiole midline along the diverging margin of the blade at its base. Range of variation is given for each population, with the frequency of the two most common classes shown as a labeled rectangle.

its tapering, short-petioled leaves; advanced traits in the complex may be the united stigma lobes of *E. klamathense,* and the erect flowers and long-petioled leaves of *E. montanum.* It is reasonable to find a species with Cascadian affinities growing at high elevations in the northern Oregon Coast Range. In Clatsop County, Saddle Mountain (Detling 1954), Onion Peak (Chambers 1973) and Sugarloaf Mountain (Chambers 1974) harbor plant species that are disjunct from the Olympic Mountains and the Cascade Range. *Erythronium elegans* may once have had a wider range in the coastal mountains of the Pacific Northwest, and have been reduced to a few relict populations by postglacial climatic changes. Although modified by genetic contact with *E. revolutum,* it is recognizable as a distinct and phylogenetically interesting species.

ACKNOWLEDGMENTS

We thank the following persons for advice and assistance with this study: K. Bierly, H. Chrostowski, M. Johnson, S. Lofton, and L. Scofield. The illustration was prepared by Julie Kierstead.

LITERATURE CITED

APPLEGATE, E. I. 1935. The genus *Erythronium*: a taxonomic and distributional study of the western North American species. Madroño 3:58–113.

BIERLY, K. F. and R. E. STOCKHOUSE. 1982. Coast fawn lily (*Erythronium revolutum*)

sensitive species conservation status report. USDA For. Serv., Pacific Northwest Region, Siuslaw Natl. For., Corvallis, OR. 82 pp.
CHAMBERS, K. L. 1973. Floristic relationships of Onion Peak with Saddle Mountain, Clatsop County, Oregon. Madroño 22:105–114.
———. 1974. Notes on the flora of Clatsop County, Oregon. Madroño 22:278–279.
DETLING, L. R. 1954. Significant features of the flora of Saddle Mountain, Clatsop County, Oregon. Northwest Sci. 28:52–60.
GILKEY, H. M. 1945. Northwestern American plants. Oregon State Coll. Monogr., Studies in Botany, No. 9.
HITCHCOCK, C. L., A. CRONQUIST, M. OWNBEY, and J. W. THOMPSON. 1969. Vascular plants of the Pacific Northwest. Part 1. Univ. Washington Press, Seattle.

(Received 9 April 1984; accepted 30 July 1984.)

NOTES AND NEWS

YELLOW JACKETS DISPERSE *Vancouveria* SEEDS (BERBERIDACEAE).—During a field study in Lewis and Clark State Park (WA: Lewis Co.) in early July 1983, I had the opportunity to study seed dispersal in *Vancouveria hexandra* (Hook.) Morr. & Dcne. (inside-out-flower). Observations were made on 3 and 4 July, at which time plants were in all stages, from open flowers to ripe seeds. The common yellow jacket *Vespula vulgaris* (L.) was fairly abundant in the area, and on eight occasions individuals were observed collecting seeds of *V. hexandra.* When an insect searching through an area covered by the plant found a dehisced pod, it alighted on the pod stalk next to it. It then bit loose the seed and its large, white appendage and flew a few meters before alighting on a low branch. It then bit the appendage off within a few seconds and dropped the seed to the ground. The yellow jacket then disappeared carrying the appendage. Apart from the eight successful searches I observed, there were also four occasions when yellow jackets searched in vain for seeds in sterile patches or in patches with unripe pods. Attempts to bite open unripe pods were never observed to be successful. Searches lasted for up to four minutes before the yellow jacket left the study area. The chemical nature of the appendage appears to be unknown, but may possibly consist of polysaccharides.

Berg (Amer. J. Bot. 59:109–122. 1972), in an extensive experimental study, showed that ants are effective seed vectors of *Vancouveria.* In repeated experiments, where seeds were put out within a few meters from nests of ant species in three genera, all seeds were dragged by the appendages to the nests within 0.5–2.5 h.

In contrast to other members of the genus, the pods of *V. hexandra* dehisce while the seeds are still green; this leaves some time before they fall spontaneously to the ground. My observations suggest that this can be an adaptation to allow seed dispersal by vespids. It should result in a more random distribution of the seeds than that provided by ants, which drag them to their nests along their trails. Berg observed ant-mediated transport up to 2.5 m from the starting point. Dispersal by the winged yellow jacket also increases the possibility of dispersal over a somewhat longer range.

To my knowledge, this is the first reported case of seed dispersal by yellow jackets. Vance Tartar (pers. comm.) has observed vespids collecting seeds of *Trillium,* another myrmecochorous genus. Further studies of vespids as seed vectors in ant-dispersed species may prove this phenomenon to be of wider occurrence.

The support of B. J. D. Meeuse during the work in the Pacific Northwest is gratefully acknowledged. This study was made while on a joint travel grant from the Swedish Natural Science Research Council (NFR) and the Royal Swedish Academy of Sciences.—OLLE PELLMYR, Dept. of Entomology, Uppsala Univ., Box 561, S-751 22 Uppsala, Sweden. (Received 6 April 1984; accepted 24 May 1984.)